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Functional Spintronic Nanomaterials
for Radiation Detection and Energy Harvesting

Spin magnetism for frequency converting at quantum computing technologies

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At present, the large distance transmission of qubit state information or long-term storage of it with the preservation of quantum coherence is one of the important problems for the implementation of quantum technologies. The prospective way to solve this problem is the use of optical laser radiation. Since superconducting qubits operate at microwaves, the design of efficient quantum converters from microwave to optical range is an urgent task.
Such a converters can be based on the ferromagnetic element in the ferromagnetic resonance condition (FMR). The main requirement for the ferromagnetic element features is the high degree of spin collinearity. Now this requirement are met by yttrium iron garnet (YIG) films performed by the order of micrometer-scaled ferrites. However, miniaturization requirements lead to usage nano-scaled ferrites.
The aim of the given submission is to present our achievements in this area. The ferrite sample as YIG film/sphere is located inside the microwave resonator which are strongly coupled [1,2]. In such a system, the key parameters are the photon-magnon coupling strength and cooperativity. Prospective planar microwave resonators with a YIG film, in which a strong photon-magnon coupling is realized [2], are under consideration. In addition, the use of nano-scaled magnetic instead single-crystal micrometer-sized YIG samples seems to be profitable for increasing the cooperativity of the system, as these kinds of magnetics possess a quite narrow FMR linewidth [1,3].
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Reference list

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